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A STUDY OF FACTORS AFFECTING MINE AND BOOBYTRAP DETECTION: SUBJECT VARIABLES AND OPERATIONAL CONSIDERATIONS

Jeffery L. Maxey, et al

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Tests were administered to and interviews conducted with military personnel identified as expert mine and boobytrap detectors, in exploratory research designed to develop methodology for identifying the characteristics of and describing the techniques used by such personnel. Only two of the psychological, ability, aptitude, and interest variables studied were significantly related to rated expertise in detection, so these variables
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may not play an important role in detection performance. None of the background information variables had any apparent relationship to expertise. Identifying highly proficient detectors on the basis of non-experiential variables is not likely to be successful, but it may be possible to identify these individuals on the basis of experience-oriented data.

HumRRO
Technical
Report

73-12

A Study of Factors Affecting Mine and Boobytrap Detection: Subject Variables and Operational Considerations

Jeffery L. Maxey and George J. Magner

HumRRO Division No. 4
Fort Benning, Georgia

HUMAN RESOURCES RESEARCH ORGANIZATION

Exploratory Research 88

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The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development, and consultation. HumRRO's mission in work performed under contract with the Department of the Army is to conduct research in the fields of training, motivation, and leadership.

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FOREWORD

This report represents the current status of a continuing research effort to identify variables that are significantly related to mine and boobytrap detection expertise. This report does not document successful achievement of the stated research objective: instead it records an initial approach explored to develop a suitable methodology for use in addressing the problem. Therefore, only a limited distribution of this report is being made at this time. Despite the preliminary nature of the research however, this report can serve to highlight certain information and findings relevant to the whole problem of mine and boobytrap detection that the combat soldier has had to contend with in the past and must be prepared, through better training, to contend with in the future.

This report presents information about operational considerations relevant to the mine and boobytrap detection process. Part of the information was collected to provide a data base from which answers could be formulated to 23 questions developed by the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Virginia.

The design and conduct of this research were accomplished by Mr. Jeffrey L. Maxey and Mr. George J. Magner under the direction of Dr. T.O. Jacobs, Director, HumRRO Division No. 4, Fort Benning, Georgia. Military support consisting of SFC J.F. Asbell, PSG Lathaniel Henderson, SP4 Lonsworth E. Smith, PFC Ennis R. Brooks, and PFC Raymond C. Singleton was provided by the U.S. Army Infantry Human Research Unit. This Unit is currently commanded by LTC Willys E. Davis; during the initial stages of the project, it was commanded by LTC Chester I. Christie.

HumRRO research for the Department of the Army is conducted under Army Contract DAHC 19-73-C-0004. Army Training Research is performed under Army Project 2Q062107A745.

Meredith P. Crawford
President
Human Resources Research Organization

PROBLEM

Casualty-producing devices such as mines and boobytraps are part of the arsenal of weapons that both conventional and insurgent forces employ in defensive and offensive postures. These devices can inflict serious casualties and may, as well, impair the individual soldier's psychological capacity and have a serious effect on a unit's method of operating in combat.

Previously collected data indicated that in Vietnam, during 1967, one-third of the casualties sustained by the units interviewed were from contact with mines and boobytraps. Since mines and boobytraps are likely to be used on future battlefields at least as much as during the Vietnam conflict, a need clearly exists to improve the soldier's ability to deal with these devices.

Unaided detection by man has long been recognized as one of the most effective means of countering this problem. If, as has been said, certain individuals have exceptional ability in this area, identifying and studying such soldiers could provide valuable information on the basis of their unusual detection ability.

The objectives of the present research were (a) to describe the tactics and techniques used by soldiers identified as expert mine and boobytrap detectors, and (b) to identify the psychological, background, and Army experience variables that differentiated expert from non-expert detectors.

Methodological problems were to identify subjects possessing the high degree of detection expertise desired, identify the specific operational considerations and individual characteristics likely to be relevant to mine and boobytrap detection, and determine the conditions under which the subjects would be studied.

APPROACH

Since there appeared to be little in the way of criteria to use in identifying the highly expert detectors that were said to exist, the opinion of peers and superiors was used to identify these rare individuals. The nomination of appropriate subjects was to be based on the known proficiency or the reputation of these individuals for detection expertise. Appropriate CONUS organizations were asked to use this technique to identify all available expert mine and boobytrap detectors and an equal number of non-experts, to be selected from Infantry, Mechanized/Armor, and Engineer units. These individuals were then to be interviewed and tested by a HumRRO research team at a mutually acceptable time.

Following this selection process, 78 subjects (71 enlisted men and 7 officers) from eight organizations were interviewed and tested at six installations. The procedure used was to administer the tests in small groups and conduct individual interviews. Subjects also completed a background information questionnaire. Additional background information was obtained from the soldier's personnel file.

The four instruments administered were (a) the HumRRO Embedded Figures Test to measure Field Independence-Dependence, (b) the HumRRO Number Comparison Test to measure ability to make rapid decisions, (c) the HumRRO Verbal Classification Test to measure ability to develop and use verbal concepts, and (d) the HumRRO Countermine Questionnaire to measure various personality dimensions or behavioral dispositions. The first three tests were administered on a time schedule and the fourth had a recommended completion time.

A basic interview guide was developed for use with Infantry subjects to obtain information on techniques and tactics employed to counter the mine and boobytrap problem. Similar guides with appropriate revisions were prepared for Mechanized/Armor and Engineer subjects.

RESULTS

Initially, the men were classified as either detection experts or non-experts based on the degree of expertise listed for them by their unit. This expert/non-expert dichotomy was not adequate to reflect the wide differences in the subjects' detection expertise. Also, additional information gained in the interviews indicated that the initial ratings were not always accurate. As a consequence, the men in the sample were re-evaluated and reclassified into the categories of (a) Highly Expert (HEx) Detector, (b) Expert (Ex) Detector, and (c) Non-Expert (N-Ex) Detector. Since the officers in the survey did not normally engage in mine and boobytrap detection activities, they were not placed in detection categories and their data were generally treated separately.

Various types of background information were analyzed to see whether differences existed among the men in the three categories of detection expertise. Nonmilitary areas examined were size of community subject lived in as a youth (e.g., farm, big city), type of outdoor activities participated in as a youth, number of years of education completed. No significant differences were noted.

Of the psychological, ability, aptitude, and interest variables examined, only two—the use of concepts as measured by the HumRRO Verbal Classification Test and ACB Pattern Analysis Test—were significantly related to detection expertise.

An analysis of the tactics and techniques employed in countering the mine and boobytrap problem revealed the following:

(1) Eight classes of mines and boobytraps accounted for 90% of the devices detected by the subjects who were rated highly expert.

(2) Visual detection was the primary means used to locate mines and boobytraps by the subjects who were rated highly expert.

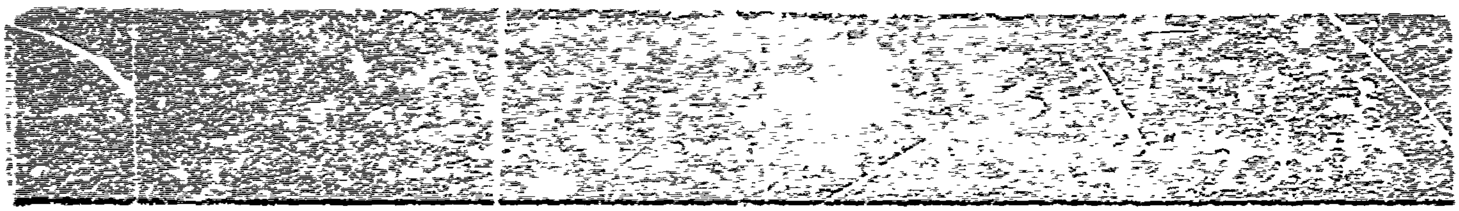
(3) The visual search procedure used by the subjects who were rated as highly expert detectors was to look out along the direction of movement to get a general view and then look back into the area in front of them for a more detailed inspection.

(4) Most subjects who were rated as highly expert detectors said that they investigated indications of mines and boobytraps that proved to be false fairly often or frequently.

(5) A high percentage of the subjects who were rated as highly expert detectors were confident of their ability to detect hidden devices while moving at their unit's normal speed.

(6) The men rated as experts considered a mine detector to be the most effective means of detecting devices placed under water.

(7) As visibility deteriorated from good to limited, there was a corresponding decrease in the average and maximum distances at which signs of mines and boobytraps could be detected. Also, the rate of movement considered practical decreased as the likelihood of encountering mines and boobytraps increased and visibility became more limited.



(8) In combat situations where contact with the enemy was possible and there was a requirement to move through an area suspected of containing mines and boobytraps, most expert subjects recommended more caution in moving and a reduction in the rate of movement. When ordered to move through an area suspected of containing mines and boobytraps while receiving enemy fire, most experts would modify the visual search procedure by advancing in short rushes, carefully examining the area between moves. If visual searching became impractical in this type of situation, most preferred to move by an alternate route.

(9) Most expert subjects felt that maneuvering around an area suspected of containing mines and boobytraps caused a unit to suffer a loss of time and a reduction in firepower. Half of the subjects felt that a unit's vulnerability to enemy fire would not be reduced while maneuvering around an area suspected of containing mines and boobytraps.

(10) A high percentage of expert subjects said they had experienced a "special feeling" that seemed to warn them of danger on a number of occasions and that in over half of these situations subsequent events confirmed the validity of the warning.

(11) Major factors that were said by experts to provide clues to assist mine and boobytrap detection efforts were variations in the environment, primarily in camouflage, vegetation, color, and soil, and enemy errors, such as warning signs for local inhabitants, failure to renew camouflage, and repeated use of the same techniques. The main factors that were said by experts to adversely affect detection efforts were unpredictable enemy concealment techniq[illegible] enemy's skill in concealing devices, and insufficient time to search [illegible]ully.

(12) A high pe[illegible]entage of experts said that fatigue and a deterioration in health would cause a reduction in their detection ability.

(13) Most subjects felt that the intelligence on the mine and boobytrap situation provided them prior to an operation was adequate.

(14) When moving on a combat operation, most subjects said their units tried to avoid mines and boobytraps by selecting routes through areas considered to be free of these devices and by using a zigzag type of movement most of the time.

(15) When mines and boobytraps were detected, they were marked most frequently by reporting to a higher headquarters and marking the area around the device. However, many subjects preferred to neutralize the devices by exploding them in place.

(16) Dogs and a small, light mine detector were viewed by experts as the most desirable alternatives to visual mine and boobytrap detection.

(17) When operating off the road, ambushes, boobytraps, and mines were considered the major threats by expert Infantry subjects because of the opportunities for concealment.

(18) Mechanized/Armor subjects reporting on vehicular operations said that in addition to the driver, visual observation was performed by the vehicle commanders, other crew members, and sometimes observers walking in front of the vehicle; communication was most frequently by radio (intercom); communication was generally direct to the driver from other

crew members rather than through a superior; and there was no firm agreement on who should direct any evasive action taken by the vehicle.

(19) Engineer subjects said that metallic debris and other suspicious objects were a significant problem for mine sweep teams.

(20) Most expert Infantry, Mechanized/Armor, and Engineer subjects thought that the use of dogs could speed up or improve visual detection in field situations.

(21) Special footwear and body armor were the most frequently suggested items for improving the conditions under which visual detection is performed.

(22) Comments and recommendations made by the subjects were quite diverse and included their thoughts on selection and training of detectors, equipment, and tactical considerations.

CONCLUSIONS

The following conclusions were reached based on exploratory research:

(1) The fact that only two of the psychological, ability, aptitude, and interest variables studied were significantly related to detection expertise suggests that these classes of variables may not play an important role in affecting an individual's detection capabilities.

(2) None of the background variables appeared to have any effect on the individual's capabilities in this area.

(3) The results suggest that attempts to identify highly proficient detectors on the basis of nonexperiential variables are not likely to be successful. This implies that it may be possible to identify proficient individuals on the basis of experience-oriented data.

(4) It is possible to collect information from combat-experienced men that will provide base data on tactics and techniques employed to counter the mine and boobytrap problem.

(5) A review of mine and boobytrap detection tasks indicates that they are highly complex and require further study to identify the knowledge and skills necessary for average or above-average detection performance.

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A Study of Factors Affecting Mine and Boobytrap Detection: Subject Variables and Operational Considerations

I

Chapter 1

INTRODUCTION

This report presents the results of a survey of U.S. Army Infantry, Engineer, and Mechanized/Armor personnel, which was conducted to determine the tactics and techniques used by personnel who have manifested a high degree of mine detection and boobytrap expertise, and to explore the psychological, background, and Army experience variables related to that expertise. The survey was conducted at selected U.S. Army installations located within the continental United States (CONUS) during March, April, and May 1972. The survey was limited to combat-experienced military personnel, some of whom had performed as expert mine and boobytrap detectors and some of whom had not.

This work was initiated by the U.S. Continental Army Command (CONARC) for FY 1972. Subsequently, the Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va., developed a set of 23 requirements in the mine/countermine research area to support on-going MERDC research. HumRRO was requested by MERDC to develop information to meet these requirements. As a consequence, the present report reflects both research and information needs of CONARC and MERDC.

MILITARY PROBLEM

Casualty-producing devices such as mines and boobytraps are part of the arsenal of weapons which both conventional and insurgent forces employ in defensive and offensive postures. As weapons, the devices can inflict serious casualties, and may also impair the individual soldier's psychological capacity to respond in an appropriate manner during a military operation. Mines and boobytraps also have a serious effect on a unit's method of operating in combat.

Previously collected data[1] indicated that in Vietnam, during 1967, approximately 33% of the casualties sustained by the units interviewed were from contact with mines and boobytraps. Since it is likely that mines and boobytraps will be used on future battlefields with at least the same frequency as they have been used during the Vietnam conflict, a need clearly exists to improve the soldier's ability to deal with these devices.

Unaided detection by man has long been recognized as one of the most effective means of countering this problem. Reports from Vietnam indicate that as much as 60% of all mine and boobytrap detections were made by visual or related means. It has also been said that certain individuals have exceptional ability in this area. If it is true that such soldiers exist, their identification and study could provide valuable information concerning the variables that form the basis for their unusual detection ability.

[1] Exploratory study of detection and avoidance of mines and boobytraps in Vietnam combat, conducted by George J. Magner, HumRRO Division No. 4, in 1968.

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RESEARCH PROBLEM

The objectives of the present research were (a) to describe the tactics and techniques used by identified expert mine and boobytrap detectors, and (b) to identify the psychological, background, and Army experience variables which differentiated expert detectors from non-expert detectors.

One of the most difficult problems encountered was the locating of individuals who could be identified as expert detectors. While hearsay reports have indicated that highly expert mine and boobytrap detectors do exist, it is not clear what dimensions would be likely to characterize these special individuals. Therefore, specifying criteria that could be used to identify expert detectors proved to be a difficult problem for which there was no completely satisfactory solution. However, certain individuals establish a reputation for detection expertise which becomes known to other members of their unit. Therefore, it was decided that selected military organizations in CONUS would be asked to identify appropriate personnel from Infantry, Armor, and Engineer units. The experts were to be nominated by their peers or superiors on the basis of known proficiency or reputation for detection expertise.

Other methodological problems posed by the research objectives were (a) the identification of the specific operational considerations and subject variables that would be likely to be relevant to mine and boobytrap detection, and (b) the determination of the conditions under which the expert and non-expert detectors would be studied.

The selection of the operational considerations and the subject variables which were studied was based upon guidance from three sources: The Mobility Equipment Research and Development Center (MERDC), a review of relevant psychological literature, and expert military opinion.

The operational considerations that were believed to be relevant to mine and boobytrap detection fell in the following categories:

(1) Factors affecting mine and boobytrap detection.
(2) Methods used to detect mines and boobytraps.
(3) Maximum and normal distance at which mines and boobytraps are detected.
(4) Speed at which detection occurs under different conditions of visibility and mine and boobytrap likelihood.
(5) Detection of mines and boobytraps under water.
(6) Mine and boobytrap detection from vehicles.
(7) Problems encountered in off-road operations.
(8) Combat tactics involving mines and boobytraps.
(9) The effect of maneuvering around detected or suspected mines and boobytraps on time lost, firepower and vulnerability.
(10) The effect of metal debris and other objects on the use of mine detectors.
(11) The adequacy of combat intelligence with respect to mines, and boobytraps.
(12) Suggested aids and equipment for mine and boobytrap detection.

The subject variables (individual characteristics) that were considered relevant fell in three broad categories: (a) personality, (b) ability, aptitude, and interest, and (c) background. The subject variables studied are listed in Table 1.

While the military topics and subject variables that would be studied were being specified, it was decided that an interview-testing format would be the most efficient and reliable method for collecting data. It was believed that the personal contact engendered by an interview situation would be more likely to elicit the undivided attention and cooperation of the subjects than would an impersonal set of questionnaires administered in a large group situation. Consequently, a HumRRO interviewing team was formed to

Table 1

Subject Variables Studied

Category	Dimension Measured
Psychological Variables	Field Independence-Dependence Tolerance of Ambiguity Internalization - Externalization Open vs. Closed Mindedness Machiavellianism Manifest Anxiety Individual Prominence Rapid Decision Making Ability to Use Concepts
Ability, Aptitude, and Interest	General Learning Ability Verbal Ability Arithmetic Ability Mechanical Ability Ability to Visualize Spatial Relationships Perceptual Speed Mechanical Aptitude Automotive Interest Electronics Interest
Background Variables	Size of community in which subject grew up Types of outdoor activities in which subject engaged as a youth Years of education completed

conduct structured personal interviews and to administer (in small groups) tests and inventories that would cover the operational considerations and subject variables selected for study.

The HumRRO team consisted of a team leader-interviewer and an assistant test administrator. The team leader was a retired Army officer with combat experience in World War II, Korea, and Vietnam. The assistant, a noncommissioned officer (E7) assigned to the U.S. Army Infantry Human Research Unit (HRU), was a Vietnam combat veteran. At one post, because of the large number of subjects to be interviewed, another Infantry HRU NCO (E7) with Vietnam experience assisted the team by conducting 10 interviews.

Chapter 2

METHOD

SUBJECTS

In order to obtain subjects for study, CONUS organizations that were believed to have appropriate personnel were contacted. They were asked to identify expert mine and boobytrap detectors and make the identified individuals available for interviewing and testing by a research team from HumRRO Division No. 4, Fort Benning, Ga., at a mutually acceptable time. It was also requested that an equal number of non-expert, combat-experienced individuals be made available for interviewing and testing during this same period. In order to provide an opportunity to study response differences as a function of their job designations, as well as their detection expertise, subjects were obtained from Infantry, Mechanized/Armor, and/or Engineer units. Where no subjects with outstanding detection expertise could be identified, these units were asked to provide individuals with considerable combat experience who were known to be highly proficient in their job. The subjects provided are listed by organization and location in Table 2.

Table 2

Mine and Boobytrap Detection Subjects Identified By Organization

Organization	Location	Subjects[a]
Ranger Department, U.S. Army Infantry School	Fort Benning, Ga.	6
197th Infantry Brigade	Fort Benning, Ga.	10
U.S. Army JFK Institute for Military Assistance	Fort Bragg, N.C.	14
82d Airborne Division	Fort Bragg, N.C.	15
4th Mechanized Division	Fort Carson, Colo.	10
III Corps	Fort Hood, Texas	14
U.S. Army Armor Center	Fort Knox, Ky.	7
U.S. Army Engineer Center	Fort Belvoir, Va.	2
Total		78

[a]71 enlisted men and 7 officers.

The subjects were 71 enlisted men (E5 through E8) and seven officers, ranging in age from 20 to 45 with the median age being 27 years. All were combat veterans with most of their experience being fairly recent in Vietnam. The median amount of combat experience was 1.80 years. During their Vietnam duty, 78.2% of the subjects had engaged in search and destroy missions, 77.0% had engaged in reconnaissance missions, and 61.5% had engaged in combat patrol missions.

MATERIALS

Materials were developed to obtain desired background information, test the subject in appropriate areas, and provide a comprehensive interview guide to obtain complete information on the mine and boobytrap detection problem. These items were used in a pilot test at Fort Benning and revised prior to the major data collection effort.

BACKGROUND INFORMATION

Basic background information was obtained by having the subject complete a questionnaire that elicited the following information: name, grade, present unit, the size of the community in which he grew up, activities he engaged in as a youth, age, amount of time in Army, types of training received, amount of time in combat, types of unit assigned to in combat, duties in combat, types of operations participated in during combat, casualties inflicted and sustained by his unit, casualties caused by mines and boobytraps, number and type of mines and boobytraps detected, methods of detection used, and mines not detected (ones found later by others).

Additional background information was obtained from the subject's personnel file. This information included the individual's General Technical (GT) aptitude area composite score, number of years of education completed, and the eight Army Classification Battery (ACB) test scores. The ACB tests provided measurements in the areas of verbal ability, arithmetic ability, mechanical ability, ability to visualize spatial relationships (pattern analysis), perceptual speed (clerical speed), automotive interest, mechanical aptitude, and electronics information.

TEST INSTRUMENTS

The four test instruments that were used in the research were developed at HumRRO Division No. 4. The HumRRO Embedded Figures Test was designed to measure Field Independence-Dependence. In this test the subject must discover the location of simple geometric figures embedded in complex geometric figures. The test was developed during HumRRO Basic Research Project 19, and has a test-retest reliability of at least .57 and a split-half reliability of .89. In addition, the test is significantly but only moderately correlated ($r = .54$; $df = 156$, $p < .01$) with the Education Testing Service's Hidden Figures Test (Cf–1), which is a highly reliable measure of the Field Independence-Dependence dimension (Jackson, Messick, and Meyers, 1). Thus, the HumRRO Embedded Figures Test appears to be a relatively reliable and moderately stable test and appears, to some extent, to measure the Field Independence-Dependence dimension.

The HumRRO Number Comparison Test (NCT) and the HumRRO Verbal Classification Test (VCT) were also developed during Basic Research Project 19. The NCT is designed to measure an individual's ability to make rapid decisions. In this test, the subject is required in a short period of time to evaluate pairs of numbers and determine

whether the components of each of the pairs are the same or different. The VCT is designed to measure an individual's ability to develop and use verbal concepts. In this test, the subject is required to think about two sets of words and develop a concept to describe each set. Next he must think about other specific words and determine to which of the two concept classes they belong. The split-half reliabilities of NCT and the VCT are .81 and .97, respectively.

The NCT and VCT are still in an experimental stage, so nothing firm is known about their construct validity. However, both of these tests have moderate correlations with Army Classification Battery (ACB) tests that measure abilities similar to those the HumRRO tests were designed to measure. For example, the ACB Verbal test correlates .49 with the VCT while the ACB Army Clerical Speed (a test similar to the NCT) correlates .33 with the NCT. Therefore, it would appear that both of the HumRRO tests are to some extent measures of the abilities they are designed to measure.

The HumRRO Countermine Opinion Questionnaire is composed of six test instruments that are measures of various personality dimensions or behavioral dispositions. The tests and the behavioral dimensions measured by the tests are presented in Table 3. Each test instrument comprising the questionnaire has been shown to have both adequate reliability and validity. The object in choosing the tests comprising the questionnaire was to select tests that measured behavioral dispositions that were likely to be associated with the ability to detect objects or devices hidden in wooded areas or in the ground.

Table 3

Test Instruments of the Countermine Questionnaire: Psychological Dimensions Measured and Reliability/ Validity of the Test Instruments

Test Instrument	Dimension Measured	Variable Correlated With or Related to Test Instrument Score	Validity Coefficient	Test-Retest Reliability	Split-Half Reliability
AT-20 Scale[a]	Tolerance of Ambiguity	Number of anagrams unscrambled in 3 minutes	.33	.63 (6 months)	.86
I-E Scale[b]	Internalization of Reward (Internal vs. external control of reinforcement, or extent to which an individual views reward as contingent upon behavior)	Rating of internal-external control	.61	.78 (1 month)	.65
Dogmatism Scale[c]	Open vs. Closed Mindedness	Synthesis portion of problem solving (High Dogmatics have more difficulty)	–	.71 (5-8 months)	.78 (corrected)

(Continued)

Table 3 *(Continued)*

Test Instruments of the Countermine Questionnaire: Psychological Dimensions Measured and Reliability/ Validity of the Test Instruments

Test Instrument	Dimension Measured	Variable Correlated With or Related to Test Instrument Score	Validity Coefficient	Test-Retest Reliability	Split-Half Reliability
Mach IV Scale[d]	Machiavellianism (Extent to which an individual agrees with the views of Machiavelli)	Trustworthiness	–.57	–	.79
		Altruism	–.54		
HumRRO TR-Anscale[e]	Manifest Anxiety	Likelihood of volunteering for hazardous duty (High scores less likely to volunteer)	–	.82 (2 weeks)	.84
IP Scale[f]	Individual Prominence (Extent to which an individual stands out in a group)	Likelihood of volunteering for performing a task (High scorers are more likely to volunteer)	–	–	.79 (corrected)

[a]MacDonald (2)
[b]Rotter (3)
[c]Rokeach (4)
[d]Christie and Geis (5)
[e]Hammock (6)
[f]Shaw (7)

INTERVIEW GUIDES

A basic interview guide was developed for use with Infantry subjects. Similar guides with appropriate revisions were prepared for Mechanized/Armor and Engineer interviews. The general areas covered by the basic interview guide were:

(1) Intelligence provided on mine and boobytrap situation.
(2) Detection assistance provided.
(3) How movement to the area of operations was accomplished.
(4) Mine and boobytraps encountered en route.
(5) Normal duty assignment on operation.
(6) If point man, time spent performing this task.
(7) The unit's method of movement on operation—formation, direction traveled, type of route, method of moving through areas.
(8) Variations that assist in detection (e.g., color, size, shape).
(9) Common enemy errors that assist in detection.
(10) Extent to which the senses of smell and hearing, an allergic reaction, or special feeling served to alert an individual to the presence of mines and boobytraps.

(11) The maximum and average distances mines/boobytraps can be detected in both good and limited visibility.
(12) Visual search SOP used by the point element.
(13) Visual detection techniques employed by point men.
(14) Individual's confidence in his ability to detect mine/boobytrap.
(15) Rates of movement considered practical in good and limited visibility when mines and boobytraps have not been encountered, are probable, and have been detected.
(16) The frequency of delay caused by mine/boobytrap indications that prove to be false.
(17) The greatest threat when moving off the road.
(18) Actions recommended in various situations:
 (a) No enemy seen, orders are to continue through suspected mine/boobytrap area.
 (b) Enemy contact may be expected, signs strongly indicate presence of mine/boobytrap.
 (c) Mine or boobytrap located—procedure used to mark location
(19) The effect on a unit in terms of time lost, firepower, and vulnerability when required to maneuver around detected or suspected mines and boobytraps.
(20) The effect on a unit's method of movement and search procedures if required to move through a suspected mined and boobytrapped area.
(21) The primary problems which occur when attempting to visually detect mines and boobytraps.
(22) The detection of mines and boobytraps placed under water.
(23) The weight carried, distance traveled, and duration of average combat operation.
(24) The effect of fatigue and the state of health on detection ability.
(25) The type of assistance recommended to improve or speed up visual detection
(26) Alternate methods used in preference to visual detection.
(27) Special equipment for point men.
(28) Opinions concerning the selection and/or training of effective visual mine and boobytrap detectors.
(29) The type of training recommended to improve visual detection capability.
(30) Comments and recommendations.

The major differences in the Mechanized Armor interview guide were the revisions or additions that follow:

(1) Duty assignments listed vehicle driver, vehicle commander, and visual observer.
(2) Methods of communication with the driver
(3) The identification of the individual directing evasive action by the vehicle
(4) The visual detection of mine/boobytrap from a moving vehicle.
(5) The visual search SOP used by observers.
(6) Special equipment for visual observer

The major differences in the Engineer interview guide were the revisions or additions that follow:

(1) The duty assignments list included members of a mine sweep team
(2) Time spent as detector operator or visual observer
(3) Opinions concerning the mine detector used
(4) Mine sweep team organization, formation, and method of communication

(5) Extent mine sweep team was attached to Infantry or Mechanized/Armor
(6) The visual search SOP for a sweep team.
(7) Delay caused by metallic debris or other objects.
(8) Percentage of mines detected visually, with a mine detector, and other means.
(9) Special equipment for detector operator.

PROCEDURE

Upon arriving at an installation, the HumRRO team finalized plans for the testing and interviewing. Usually, two small rooms were provided and an appropriate number of subjects scheduled for morning or afternoon sessions. At each session, the HumRRO team leader briefed the subjects on the purpose of the research and then divided the group into test and interview elements.

The men in the interview element first completed the Background Information Questionnaire; it was reviewed by the team leader with the individual before the interview to ensure completeness. The team leader then conducted the interview, using an interview guide to ensure consistency and completeness. A copy of the guide was given to the subject and, where necessary, questions were explained to ensure understanding. The subject verbally answered the questions and his responses were recorded by the team leader on his copy of the interview guide; a complete record of the conversation was made by tape recorder. While the interview was somewhat structured by the guide employed, individuals were encouraged to give additional information when appropriate. Subjects were interviewed using either Infantry, Mechanized/Armor, or Engineer interview guides as appropriate to their background and combat experience.

Concurrently, the HumRRO test administrator gave the required tests to subjects in the test element. Each subject completed the four standardized tests. The first three tests were timed tests and were administered according to a prearranged time schedule. The Countermine test instrument did not have a time limit, but subjects were encouraged to complete it within two hours. After the subjects finished the tests, the administrator briefly described the purpose of the various instruments.

When the subjects who were interviewed first were through, they took the four standardized tests. When the subjects who were tested first were through, they began preparing for their interview by completing the Background Questionnaire. As an interview slot became available, these individuals were interviewed by the team leader. The rotating of individuals between testing and interviewing attempted to make maximum use of the available subjects.

The test administrator also visited the organization's personnel office to obtain additional information from the subject's records. This information included number of years of education completed, ACB test scores, and GT aptitude area composite score.

Chapter 3

RESULTS

CLASSIFICATION OF SUBJECTS

The subjects were initially placed into two categories—Expert or Non-Expert—of mine and boobytrap detection capability, on the basis of the degree of expertise listed for the individuals by their unit. However, the detailed interviews indicated that some of these initial ratings were not accurate. Also, preliminary analysis of the interview data indicated that the Expert/Non-Expert dichotomy was not adequate to handle the wide differences in detection expertise that existed among the subjects. As a consequence, the subjects were re-evaluated and reclassified into one of the following categories in order to more accurately reflect the differences existing among subjects:

(1) Highly Expert (HEx) Detector: An individual who had considerable mine and boobytrap detection expertise and who manifested an outstanding knowledge of the skills required to perform as a detector.

(2) Expert (Ex) Detector: An individual who had some mine and boobytrap detection experience and who manifested considerable knowledge of the skills required to perform as a detector.

(3) Non-Expert (N-Ex) Detector: An individual who may or may not have had some mine and boobytrap detection experience, but who was familiar with the skills required to perform as a detector.

(4) Officers: Individuals who did not normally engage in mine and boobytrap detection activities, but who had considerable knowledge of the tactics and techniques involved.

The results of this reclassification, including job designation, are presented in Table 4. It is clear that there was an uneven distribution of the enlisted subjects with respect to job designation. As a consequence, analyses conducted to study differences in detection expertise with respect to a given variable ignored job designation.

Table 4

Subjects Classified by Detection Expertise And Combat Arms

Combat Arm	Detection Expertise[a]				
	HEx	Ex	N-Ex	Officer	Total
Infantry	24	20	12	3	59
Mechanized/Armor	1	2	5	2	10
Engineer	0	1	6	2	9
Total	25	23	23	7	78

[a]HEx - Highly expert, Ex - Expert, N-Ex - Non-expert.

Since the officers did not normally engage in mine and boobytrap detection activities, they were not placed in one of the three detection expertise categories. Their data were treated separately except for instances where the answer to a research question did not require comparison among the different categories of detection expertise.

It should be noted that the initial and final classification of the subjects into detection expertise categories was performed prior to the scoring of the tests and the tabulations of the background information.

SUBJECT VARIABLES (INDIVIDUAL CHARACTERISTICS)

Subject variables considered were background, psychological characteristics, and ability, aptitude, and interest.

BACKGROUND

To determine whether the level of detection expertise manifested during the interviews was related to the subject's *nonmilitary* experience, three indices of this experience were studied: (a) the size of community in which the subject grew up, (b) the types of outdoor activities in which he participated as a youth, and (c) the number of years of formal education he had completed. A chi-square analysis of the proportions of the HEx, the Ex, and the N-Ex subjects who grew up in either a farm/country area, a small town, a small city, or a large city/metropolitan area (Table 5) revealed that there were no significant differences among the three levels of detection expertise with respect to these proportions.

Table 5

Proportion of Subjects by Expertise Groups Who Grew Up in Four Sizes of Communities

Area Where Subject Grew Up	Detection Expertise[a]		
	HEx	Ex	N-Ex
Farm/Country	.36	.26	.22
Small Town (<10,000 pop.)	.20	.35	.22
Small City (10,000-50,000 pop.)	.20	.13	.30
Large City/Metropolitan Area (>50,000 pop.)	.24	.26	.26

[a] χ^2 (6) = 3.92, ns.

The proportion of subjects that reported engaging in hunting, hiking, and athletic activities as youths was computed for the HEx, Ex, and N-Ex groups (Table 6). A chi-square analysis showed that for none of these activities were the between-group proportions significantly different.

Analysis of variance of the number of years of formal education completed by subjects in each of the three detection expertise groups showed that the between-groups differences were not significant.

Table 6

Proportion of Subjects by Expertise Groups Who Reported Engaging in Three Kinds of Activities as Youths

Activity	Detection Expertise HEx	Ex	N-Ex	χ^2	*df*	*p*
Hunting	.68	.65	.87	3.31	2	NS
Hiking	.88	.74	.87	2.05	2	NS
Athletics	.80	.83	.74	0.55	2	NS

Thus, with respect to the subject's nonmilitary background, none of the experience areas explored was related to the subject's detection expertise.

PSYCHOLOGICAL VARIABLES

A one-way analysis of variance was performed on each of the nine sets of cognitive and personality test scores with the between-subjects' variable defined as the level of detection expertise manifested by the enlisted subjects during their interviews (Table 7). For only one of these psychological variables, Use of Concepts (which was measured by the HumRRO Verbal Classification Test), were the differences among the expertise groups significant ($F(2, 67) = 4.79, p < .05$). Thus, of the nine psychological variables studied, only one, Use of Concepts, was significantly related to the ability to detect mines and boobytraps as defined by the three levels of detection expertise.

Table 7

Performance of Expertise Groups by the Cognitive and Personality Dimensions Measured

Dimension Measured	HEx N	HEx $\bar{X}$	HEx SD	Ex N	Ex $\bar{X}$	Ex SD	N-Ex N	N-Ex $\bar{X}$	N-Ex SD	*F*	*df*	*P*
Field Independence-Dependence	25	12.4	6.1	23	9.7	6.2	22	9.6	6.5	1.5	(2,67)	NS
Rapid Decision Making	25	41.8	8.9	23	36.2	7.3	22	40.1	11.6	2.2	(2,67)	NS
Use of Concepts	25	53.2	7.1	23	46.9	11.4	22	44.0	12.4	4.8	(2,67)	< .05
Tolerance of Ambiguity	25	8.9	3.2	23	8.7	2.8	21	8.5	2.9	0.1	(2,66)	NS
Internalization of Reward	25	8.1	4.1	23	8.2	2.8	21	8.1	4.0	0.0	(2,66)	NS
Open vs. Closed Mindedness	25	4.0	0.8	23	3.8	0.6	21	4.0	0.7	1.0	(2,66)	NS
Machiavellianism	25	3.8	0.7	23	3.6	0.8	21	3.6	0.9	0.5	(2,66)	NS
Manifest Anxiety	25	12.4	7.2	23	13.5	7.0	21	11.3	6.6	0.5	(2,66)	NS
Individual Prominence	25	4.6	0.6	23	4.2	0.6	21	4.2	0.5	0.3	(2,66)	NS

ABILITY, APTITUDE, AND INTEREST

A one-way analysis of variance was performed on each of the ability, aptitude, and interest test scores collected, with the between-subjects' variable defined as the level of detection expertise manifested by the enlisted subjects during their interviews (Table 8). For each variable, none of the differences among the three expertise groups was significant at a reliable level. These results suggest that none of the usual measures of a soldier's ability, aptitude, or interest are significantly related to his mine and boobytrap detection ability as defined by the three levels of detection expertise.

Table 8

Performance of Expertise Groups by ACB and GT Scores

	HEx			Ex			N-Ex					
Scores[a]	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	F	df	P
ACB												
Verbal	16	111.5	16.1	16	100.8	26.9	14	103.7	23.1	1.0	2,43	NS
Arithmetic	16	100.5	18.8	16	94.2	18.4	14	98.6	[illegible]	0.6	2,43	NS
Shop Mechanics	16	107.6	14.5	16	111.3	27.2	14	101.9	15.9	0.8	2,43	NS
Pattern Analysis	16	102.8	22.9	16	100.5	19.5	14	112.6	12.4	1.7	2,43	NS
Clerical Speed	16	104.6	18.6	16	107.6	27.5	14	103.4	18.3	0.2	2,43	NS
Automotive Information	16	100.9	15.4	16	101.0	15.9	14	101.5	17.4	0.0	2,43	NS
Mechanical Aptitude	16	106.6	12.1	16	100.6	15.6	14	100.4	20.9	0.7	2,43	NS
Electronics Information	16	103.8	16.1	16	97.5	21.9	14	99.4	22.9	0.4	2,43	NS
GT	17	106.3	14.6	18	99.6	17.0	14	102.1	20.0	0.8	2,46	NS

[a]ACB, Army Classification Battery tests; GT, General Technical (aptitude area) test.

CORRELATION ANALYSIS OF PREDICTOR VARIABLES

The fact that none of the predictor variables discriminated between the groups as constituted led to the suspicion that the process by which these groups had been formed had been less than accurate. Consequently, supplementary analyses were undertaken to determine whether the criterion of "expertness" had been fallacious.

A second member of the research staff, with substantial experience in small-unit operations, was asked to develop a set of criteria for judging expertness in mine and boobytrap detection. A numerical rating was assigned to each subject in the sample by applying these criteria to the interview data. These ratings were correlated with those obtained from the application of the original criteria. (Both sets of criteria, together with procedures for developing numerical ratings from them, are presented in Appendix A.) The resulting correlation was .78, which is highly significant, $p < .001$. Since these two sets of numerical ratings were obtained independently, it was concluded that both

classifications were based on essentially the same variables, and that the reliability of original classification was satisfactorily high. Consequently, the two sets of numerical ratings were combined, using a standard score procedure, to obtain a single criterion score of higher reliability.

This resulting single score was then combined with each of the psychological and ability, aptitude, and interest variables, with the result shown in Table 9. As can be seen, the obtained relationships were quite weak. Only two relationships—one with Verbal Classification and one with Pattern Analysis—were significant, and each only barely so. The results of these analyses support the results of the preceding by-groups analyses, suggesting that there were essentially no relationships between the predictor variables selected for study and boobytrap detection expertise.

Table 9

Correlation of Psychological and Ability, Aptitude, and Interest Variables With Combined Criterion of Detection Expertise

Psychological Variables	r	df	Ability, Aptitude, and Interest Variables	r	df
Field Independence-Dependence (EFT)	.08	68	ACB Verbal	.12	44
Rapid Decision Making (NCT)	−.02	68	ACB Arithmetic	−.01	44
Use of Concepts (VCT)	.25[a]	68	ACB Shop Mechanics	.05	44
Tolerance of Ambiguity (AT-20 Scale)	.04	67	ACB Pattern Analysis	−.32[a]	44
Internalization-Externalization (I-E Scale)	.06	67	ACB Clerical Speed	−.07	44
Open vs. Closed Mindedness (Dogmatism Scale)	.07	67	ACB Automotive Information	−.12	44
Manifest Anxiety (Anscale)	.17	67	ACB Mechanical Aptitude	.01	44
Machiavellianism	.14	67	ACB Electronics Information	−.09	44
Individual Prominence (IP Scale)	.20	67	General Technical Score	.06	47

[a] $p < .05$

TECHNIQUES AND TACTICS EMPLOYED

During the interviews, subjects were questioned on the detection techniques employed and the tactics that would be used when mines and boobytraps were encountered. This information provided the data base from which answers to a number of questions posed by MERDC were formulated. Answers to specific questions were based on data summaries from subjects who appeared to possess the level of expertise required for a knowledgeable reply. Since it was also desired that the implications of the data summaries be considered, those summaries which were related to similar topics were grouped and the results developed.

DETECTION TECHNIQUES USED BY THE HIGHLY EXPERT

Since the soldiers classified as Highly Expert (HEx) were considered the most proficient mine and boobytrap detectors, their answers were used to develop the description of the detection techniques typically employed. The responses of these subjects for each topic are summarized in Tables 10 through 16 and described in the following paragraphs.

The types of mines and boobytraps detected by the HEx are listed in Table 10. It should be noted that grenade boobytraps, U.S. ordnance Claymore mines, BLU-3 (CBU). 82mm Chicom mortar rounds, 25-30 lb. wrapped packages, and cartridge traps accounted for an average of 90.4% of the mine and boobytrap devices found by these subjects.

The types of initiating means detected by the HEx are presented in Table 11. Trip-wire-activated and command-detonated devices were detected by at least 7?%. In terms of the median number found, trip-wire-activated devices were encountered most frequently.

The various means used to detect mines and boobytraps are listed in Table 12. Visual means were used most frequently (68.5%), followed by use of a dog, touch, actual contact, and use of a mine detector. A large percentage of individuals (56%) reported that making actual contact (hitting by an element of their unit) was the means of detection 7.3% of the time.

The visual search procedures used to detect mines and boobytraps are listed in Table 13. The primary procedure used (48% of subjects) was to look out along the direction of movement to get a general view of the area and then gradually observe back into the area in front of the individual along this same direction. A secondary search procedure used by the largest percentage of the subjects (40%) was to look to both flanks during the search.

The frequency with which the men reported observing indications of the presence of a mine or boobytrap which, upon investigation, proved to be false is shown in Table 14. Sixty-four percent indicated that visual "false alarms" were experienced either fairly often or frequently.

Eighty-four percent of the subjects indicated that they were either confident or very confident of their ability to detect mines or boobytraps while moving at their unit's normal rate of speed (Table 15).

The means used to detect mines and boobytraps placed under water are listed in Table 16. Of those who reported that mines could be detected under water (40% of the HEx), the highest proportion (50%) believed that a mine detector was the most effective means of detection. However, 60% of the subjects either had no experience in detecting devices placed under water or did not think they could be detected.

TACTICS USED BY THE HIGHLY EXPERT WHEN MINES AND BOOBYTRAPS ARE ENCOUNTERED

In addition to the basic problem of detecting mines and boobytraps, units must frequently make changes in their tactics when these devices are encountered. Detection capabilities, therefore, continue to influence the type of tactics employed. Data from the detectors rated as highly expert were used to provide the best available information concerning the tactics typically employed in such situations. Their responses for each topic are summarized in Tables 17-20 and described in the following paragraphs.

Table 10

Devices Detected by the Highly Expert, and Mean Percent of All Devices Found, by Type

Type of Device	Percent of HEx Reporting Finding Each Device (N=25)	Mean Percent of All Devices Found
Grenade Boobytrap	96	37.3
U.S. Ordnance (Mortar/Artillery Rounds/AF Bombs)	76	20.0
Claymore Mines	72	9.7
BLU-3 (CBU)	40	7.6
82mm Chicom Mortar Rounds	52	6.3
Wrapped Package (25-30 lb.)	44	4.8
Cartridge Trap	32	4.7
Standard Metal Pressure Mine	36	3.8
Round Chicom-Type Mines	24	1.7
M1A1 Mine (U.S. & Chicom)	28	1.4
Minimum Metal Pressure Mine	20	1.2
Bouncing Betty	8	1.0
River Mine	4	.4
M72 Law	4	.1

Table 11

Percent of the Highly Expert Who Detected Each of Five Initiating Means, and the Median Number of Detected Devices Using Each Means

Initiating Means	Percent of HEx Detecting Each Means (N=25)	Median Number of Detected Devices Using Each Means
Trip Wire	80	25
Command Detonated	72	4
Standard Metal Pressure	36	5
Minimum Metal Pressure	20	10
Tilt Rod	16	4

Table 12

Percent of the Highly Expert Who Reported Using Each of Five Means of Detection to Find Concealed Devices, and Median Percent of Time Each Method Was Used

Means of Detection	Percent of HEx Reporting Utilization (N=25)	Median Percent of Time Mean Was Used
Visual	96	68.5
Actual Contact With a Device	56	7.3
Tactual (Touch)	36	12.1
Use of a Trained Dog	28	15.5
Use of a Mine Detector	20	5.6

Table 13

Visual Search Procedures Used by the Highly Expert

Visual Search Procedure	Percent of HEx Who Reported Using Each Procedure (N=25)
Primary	
Look out along the direction of movement and then look back in along this direction	48
Look along the direction of movement	24
Sweeping back and forth, scan the area immediately forward of the unit's position	16
Look out along the direction of movement, starting with the area directly forward of the unit's position	12
Secondary	
Look to both flanks (right and left)	40
Look in trees for snipers	4
Look under the brush	4
No secondary procedure reported used	52

Table 14

Percent of the Highly Expert Who Reported Experiencing Each of Four False Alarm Rates

False Alarm Rate	Percent of HEx Reporting Each Rate (N=25)
Never	8
Seldom	28
Fairly Often	48
Frequently	16

Table 15

Percent of the Highly Expert Who Reported Specified Levels of Confidence in Ability to Detect While Moving at Unit's Normal Speed

Level of Confidence	Percent of HEx Reporting Each Level (N=25)
Not Confident	16
Confident	52
Very Confident	32

Table 16

Percent of the Highly Expert Who Reported Using Each of Five Means of Detection to Locate Devices Under Water

Means of Detection	Percent Utilization by HEx Reporting Use[a] (N=10)
Use of a detection device	50
Tactual means	40
Use of a stick to probe	30
Visual means	30
Use of signs in the mud	20

[a]Of the total HEx groups, 36% had not had any experience in detecting devices placed under water and 24% did not think that devices placed under water could be detected.

Table 17

Normal and Maximum Distances, and Maximum Practical Speeds, for Detection of Concealed Mines and Boobytraps

Visibility	Rate of Detection	N	Median[a]
	Detection Distance		
Good	Normal (Average)	24	9.3 meters
	Maximum	25	26.6 meters
	Maximum Practical Speed		
	No M/BTs Detected	24	900 meters/hr.
	M/BTs Probable	24	500 meters/hr.
	M/BTs Detected	24	421 meters/hr.
	Detection Distance		
Limited	Normal (Average)	24	5.9 meters
	Maximum	25	6.9 meters
	Maximum Practical Speed		
	No M/BTs Detected	24	700 meters/hr.
	M/BTs Probable	24	451 meters/hr.
	M/BTs Detected	24	226 meters/hr.

[a]The distance estimates on which these medians are based came from 25 HEx Infantry and Armor/Mechanized subjects. The speed estimates were provided by 24 HEx Infantry subjects (there were no HEx Engineer subjects).

Table 18

Actions Recommended by the Highly Expert in Two Combat Situations

Situation	Recommended Action	Percent of HEx Recommending the Action[a] (N = 25)
Unit ordered to advance through area where mines/boobytraps are suspected; no enemy signs observed.	Exercise special care in moving	64
	Reduce speed	60
	Continue advancing	24
	Request additional assistance	12
Unit ordered to advance through area where signs strongly indicate presence of mines/boobytraps; enemy activity possible.	Alert unit, stop and look more carefully	68
	Report and continue to move	44
	Attempt positive identification	28
	Report and wait for orders	16
	Continue advancing	4

[a]Subjects could make more than one response per question, so percentages can add to more than 100%.

Table 19

Percent of the Highly Expert Recommending Modifications in Visual Search Techniques in Unusually Hazardous Conditions

Situation	Modification	Percent of HEx Recommending the Modification[a] (N=25)
Unit ordered to advance through area suspected of containing mines/boobytraps when under enemy fire.	Move by short rushes, carefully examining the area between moves	40
	Move faster	24
	Move slower	24
	Be more careful in observing	24
	Be less careful in observing	12
	Attempt to clear the area with weapons fire	8
	Keep well dispersed during movement	4
Same situation, when visual searching becomes impractical	Move by an alternate route	63
	Move on through rapidly, disregarding the mine and boobytrap threat	33
	Ask headquarters for advice	4

[a]Subjects could make more than one response per question, so percentages can add to more than 100%.

Table 20

Effect of Maneuvering Around Detected or Suspected Mines/Boobytraps on Four Operation Factors

Operation Factor Affected by Maneuvering	Percent of HEx Indicating Maneuvering Would Affect Operation Factor[a] (N=25)	Median Extent Factor Was Affected
Time lost	88	13 Minutes lost
Effectiveness of unit weapons fire	72	42% reduction
Unit's vulnerability to enemy fire	48	26% reduction
Unit's speed	96	45% reduction

[a]Subjects could make more than one response per question, so percentages can add to more than 100%.

The difference in the average and maximum distances at which signs of mines and boobytraps may be detected (Table 17) is much greater in good visibility (mdn = 9.3 meters avg., 26.6 meters max.) than when visibility is limited (mdn = 5.9 meters avg., 6.9 meters max.). Also, the maximum rate of movement considered practical when attempting to detect mines and boobytraps decreased as the likelihood of encountering these devices increased. As could be expected, the maximum practical speed was always greater in good visibility than in limited visibility for a similar condition of mine and boobytrap likelihood.

The actions recommended in two combat situations involving mines and boobytraps are reported in Table 18. In a situation where no signs of the enemy have been observed, and an advance through an area that is suspected of containing mines and boobytraps has been ordered, the actions recommended by most of the highly expert were to exercise special care in moving (64%) and to reduce speed (60%). In a situation where an advance has been ordered through an area where signs strongly indicate the presence of mines and boobytraps and enemy contact is possible, the actions recommended by most were to alert the unit, stop and look more carefully (68%), and report and continue to move (44%).

Table 19 reports a situation where enemy fire (small arms, mortar) is being received and an advance has been ordered through an area that is strongly suspected of containing mines and boobytraps. The modification of visual search procedures suggested most often (40%) in this situation was to move by short rushes, carefully examining the area between moves. In this same situation, subjects were asked what action they would take in the event visual searching became impractical because of enemy fire, for example. Most subjects (63%) preferred to move by an alternate route, with the next choice being to move on through the area rapidly, disregarding the mine and boobytrap threat (33%).

When a unit encounters an area where mines and boobytraps are suspected or detected, they frequently attempt to maneuver around it. Table 20 lists the effect of this maneuvering in certain operational areas. Most men (88%) felt that some time would be lost due to the need to maneuver. A reduction in the unit's rate of movement of 45% was also listed. When in contact with the enemy and maneuvering to avoid mines and boobytraps, 72% felt that their unit's firepower was reduced; the reduction was estimated at 42% (median). Fifty-two percent indicated that the unit's vulnerability to enemy fire would not be reduced as a consequence of maneuvering. For those subjects who said vulnerability would be reduced (48%), the median percent of estimated reduction was 26%.

NON-VISUAL MEANS OF DETECTION

As noted in Table 12, most mines and boobytraps were detected visually and relatively few were detected using tactual means (sense of touch). However, since there are other means that might logically be used to alert an individual to the presence of mines and boobytraps, subjects were asked whether they were ever alerted by these means—smell, hearing, allergic reaction, and special feelings (emotional reaction).

The responses of the HEx and Ex subjects, as listed in Table 21, indicate that the only means used by a high proportion of the subjects was the "special feeling" which seemed to warn them of danger. This special feeling was experienced by the subjects 18.7 times (median); subsequent events confirmed the validity of the warning provided by the "special feeling" 65.5% of the time (median).

Table 21

Non-Visual Sensory Means by Which Experts Were Alerted to Presence of Mines and Boobytraps[a]

Sensory Detection Means	Percent of HEx and Ex Reporting Using The Detection Means (N=48)	Percent of HEx and Ex Reporting Not Using the Detection Means (N=48)
Olfactory Means[a]	29	67
Auditory Means[a]	29	68
Allergic Reaction[a]	6	90
"Special Feeling"	97	3

[a]While multiple responses were possible, several HEx and Ex subjects did not respond; hence, percentages do not sum to 100%.

FACTORS AFFECTING DETECTION PERFORMANCE

Many factors influence an individual's ability to detect mines and boobytraps. To establish the relative importance of these factors, HEx and Ex personnel were asked to identify those they felt had a significant effect on detection capabilities. The factors considered included the effects of (a) variations in the target and environment; (b) enemy errors in device concealment; (c) problems adversely affecting detection capabilities; (d) fatigue, and health deterioration. The responses are summarized in Table 22.

Table 22

Relative Importance of Factors Affecting Experts' Detection Performance

Factor	Percent of HEx and Ex Reporting Ability was Affected[a] (N=48)	Median Percent of Time Ability Was Affected
Target/Environmental Characteristic		
M/BT camouflage	60.5	32.1
Vegetation surrounding the M/BT	58.0	25.5
M/BT color	48.0	21.9
Soil surrounding the M/BT	41.0	20.0
M/BT shape	37.5	17.0
M/BT size	20.8	8.5
Texture of the M/BT	14.6	12.5

(Continued)

Table 22 (Continued)

Relative Importance of Factors Affecting Experts' Detection Performance

Factor	Percent of HEx and Ex Reporting Ability was Affected[a] (N=48)	Median Percent of Time Ability Was Affected
Enemy Mistake		
Native Warning Signs	60.5	18.5
Unrenewed Camouflage	59.3	14.6
Repetition of the Same Technique	46.0	20.0
Tactical Considerations	43.8	23.7
M/BT Partially Exposed	41.9	9.2
Triggering Device Exposed	37.5	10.0
Disturbed Vegetation	35.4	15.5
Disturbed Soil	35.4	14.2
Inadequate Camouflage	31.2	22.5
Natives Point out Where a Device is Located	14.6	8.9
Situational Elements		
Unpredictable concealment technique	73.0	27.5
Enemy skill	73.0	19.1
Not enough time to search	58.3	26.6
Combat stress	43.9	14.4
Excess fatigue	39.6	17.5
Extended time on the job	37.4	9.1

[a] Subjects could make more than one response per question, so percentages add to more than 100%.

Most subjects felt that variations in camouflage, vegetation, color, and soil provided the most help in detecting mines and boobytraps.

Common enemy errors that provided detection clues were reported by most subjects as being enemy warning signs put up to safeguard their people, failure to renew camouflage, continual use of the same techniques. These same errors, along with inadequate camouflage, disturbed vegetation, and disturbed soil, helped detection efforts a greater percentage of the time.

Most subjects reported that the factors that made detection difficult the greatest percentage of the time were the unpredictable concealment techniques of the enemy, the enemy's skill in concealing the devices, and insufficient time to look carefully.

To assess other factors important to detection capabilities, HEx and Ex subjects were asked what effect fatigue and a deterioration in health would have on their performance. Eighty-two percent indicated that fatigue had affected their detection

ability to either a moderate or a considerable degree, and 89% indicated that a deterioration in their health (e.g., a bad cold, diarrhea) would affect their detection ability. They estimated that the percentage of reduction in detection ability due to health problems would be 41.2% (median).

EFFECT OF OTHER COMBAT ACTIVITIES

Many combat activities other than basic visual detection efforts contribute either directly or indirectly to the countering of the mine and boobytrap threat. These activities include the furnishing of intelligence on the mine and boobytrap situation prior to an operation, the type of route used by a unit to move through an area, the marking of devices when they are located, and the use of non-visual detection methods. Since all combat-experienced personnel should be knowledgeable in these areas, data from all subjects are used to report on these topics. The responses are summarized in Tables 23 through 26.

Subjects were asked what type of intelligence on mines and boobytraps was received prior to an operation and whether it was adequate. Information most frequently received, as noted in Table 23, was on recent enemy activity in the area and on the types of mines and boobytraps most likely to be encountered. Most of the subjects (73%) indicated that the intelligence provided was adequate. Those who did not consider it adequate wanted information that was more up to date; books, photographs, and general information about the operational area; and data on the location of friendly mines.

With regard to methods of moving through an area, subjects were asked whether their units traveled in directions that were zigzag, straight-line, or circuitous (Table 24). A zigzag route was used by most subjects (74.5%), and was also used a high percentage (77.4) of the time by those employing this method. These results indicate that the units attempted to vary their direction of movement frequently to prevent the enemy from setting up mines, boobytraps, or ambushes on an anticipated route.

Asked whether their movement through an area was based on selecting routes they considered free of mines and boobytraps or looking for the devices as they moved through the area, the majority (69.1%) indicated that their basic procedure was to look for routes thought to be free of mines and boobytraps while the remainder said they put the emphasis on careful searching as they moved. Many of those who attempted to select a route free of devices said they also continued to search somewhat while moving.

The methods used to mark the location of mines and boobytraps when they were detected are listed in Table 25. Methods used most frequently were to report the location and type of device to the next higher headquarters and clearly mark the area around the item's location. However, 35 of the 78 subjects interviewed indicated that they would prefer to neutralize the device by exploding it in place. Individuals operating on long-range reconnaissance-type missions generally did not want to mark or explode the device as these actions might reveal their presence, and usually reported the location of the device at a later time.

Table 26 lists the visual detection alternatives preferred by Infantry, Mechanized/Armor, and Engineer subjects and the frequency with which each method was ranked first. Infantry subjects ranked dogs first, followed by a small light mine detector (which was described to them as a developmental item that would be practical for use in off-road situations). Mechanized/Armor and Engineer subjects preferred a mine detector with dogs being their second choice. These choices are reasonable in view of the method of operation of the different organizations and their degree of familiarity with the alternatives.

Table 23

Frequency With Which Various Types of Intelligence Were Furnished Prior to Combat Operation

Type of Intelligence	Reported Frequency[a] (N=78)
Recent enemy activity	57
Types of mines/boobytraps likely	40
Characteristic enemy technique	33
No intelligence provided	7

[a]Subjects could make more than one response

Table 24

Types of Route Followed During Combat

Type of Route Followed	Percent Reporting They Followed Route During Combat (N=78)	Median Percent of Time Type of Route Was Used (N=78)
Zigzag route	74.5	77.4
Straight-line route	47.5	41.8
Circuitous route	28.2	30.0

Table 25

Methods Used to Mark the Location of Mines and Boobytraps

Method of Marking Location	Percent Who Used the Method[a] (N=78)
Report to the next higher HQ the type and location of the device	54
Clearly mark the area	39
Post soldier at the location and alert column	30
Pass the information back and proceed	27

[a]Thirty-five subjects indicated they would prefer to neutralize the mine by exploding it in place.

Table 26

Alternatives to Visual Detection Ranked First

Unit	Alternatives	Percent Ranking Each Alternative First
Infantry (N=59)	Dogs	28
	Small light mine detector	18
	No alternative method	9
	Light stick	1
	No response	3
Mechanized/Armor (N=10)	Mine detector	6
	Dogs	1
	No response	3
Engineer (N=9)	Mine detector	5
	Dogs	2
	Heavy roller	2

OFF-ROAD OPERATIONS

When moving off the road in terrain that provides opportunities for concealment, there is always the threat of being ambushed, running into mines or boobytraps, receiving long range fire, or other dangers. Subjects were asked to rank these problems in terms of their importance, and to explain why they considered their number-one problem the major threat.

As noted in Table 27, Infantry HEx and Ex subjects listed ambushes as their most important problem, primarily due to the surprise element possible in areas providing concealment and the likelihood that the enemy would employ an ambush in this type of area. Boobytraps were ranked next in importance, being harder to detect in off-road operations and being a major threat in this type of operation with their use highly probable.

Table 27

Off-Road Operations Problems Ranked Most Important by Expert Infantry Subjects

Problem	Percent of HEx and Ex Ranking Problem Most Important (N=44)
Ambushes	48
Boobytraps	34
Long-range fire	13
Detection by enemy	5
Mines	0

Mechanized/Armor and Engineer HEx and Ex subjects reported that mines (N = 2) and ambushes (N = 2) were their most important off-road problems. The importance of mines was said to be due to the difficulty of detection in the type of area found in off-road operations, the surprise factor, and their being the greatest threat in these areas. Ambushes were considered an important problem because they were easy to set up in this type of area and harder to detect.

Considering the information provided by the Infantry and Mechanized/Armor and Engineer interviews, it is clear that the three most important problems faced by soldiers in off-road operations are (a) ambushes, (b) boobytraps, and (c) mines. The major reason these items are problems is the concealment provided by off-road areas.

SPECIAL AIDS AND EQUIPMENT

Infantry HEx and Ex soldiers were asked to rank in order of anticipated value the type of items that would help them to improve or speed up visual detection. As noted in Table 28, the aids they thought would help most in providing detection assistance were dogs and a small, light mine detector.

Table 28

Detection Aids Infantry Experts Consider Most Valuable

Detection Aid	Frequency of Ranking as Most Valuable[a] (N=44)
Dogs	16
Small light mine detectors	11
Vision assistance device	7
Advanced training	5
Small probing stick	1

[a]Four HEx and Ex subjects indicated that no aids would improve or speed up visual detection.

The only aid that the Mechanized/Armor and Engineer HEx and Ex subjects felt would provide valuable assistance in speeding up or improving visual detection was the use of dogs. Thus dogs were the one aid that Infantry, Mechanized/Armor, and Engineer respondents agreed on as being some help in this area.

The HEx and Ex subjects were asked to recommend the type of personal equipment that could be used to improve the conditions under which visual detection is performed. Thirty-one of these subjects indicated what kinds of personal equipment could be used to improve the conditions for visual detection. As noted in Table 29, special footwear and body armor were suggested most frequently, followed by lighter and smaller equipment and a rod for probing.

Table 29

Equipment Suggested to Improve Visual Detection Conditions

Equipment	Percent of HEx and Ex Responding Who Suggested Item[a] (N=31)
Special footwear	19
Body armor	19
Lighter, smaller equipment	13
A probe rod	13
Spectacles	3
Improved clothing	3

[a]Subjects could make more than one response.

VEHICULAR OPERATIONS

In order to study the effect of mines and boobytraps on vehicular operations, the 10 Mechanized/Armor subjects were questioned about visual observation from a vehicle, communications between visual observers and the driver, the directing of evasive action by the vehicle, and the vehicle speed considered practical while attempting to detect mines and boobytraps.

Six of the subjects had acted as the commander of a tank, armored personnel carrier, or a jeep, while the others were members of a vehicle crew. In answer to the question of who, other than the driver, attempted to visually detect mines and boobytraps, subjects reported that vehicle commanders (N = 9), other crew members (N = 9), and observers walking in front of the vehicle (N = 2) also performed this task.

Respondents frequently said that while vehicle commanders did observe for mines and boobytraps, much of their attention was directed to tactical matters with specific detection functions being performed by other members of the crew. However, all crew members generally had areas of observation responsibility while moving. The technique of placing an observer on the forward slope of an armored vehicle for detection purposes was not used by any of the respondents.

On methods of communicating with the driver, the visual observer usually used radio (intercom N = 6), followed by voice (N = 4), hand-and-arm signal (N = 3), and touch (N = 2). Direct communication from a crew member to the driver was the communication procedure used most frequently (N = 7), followed by visual observer through a superior to the driver (N = 2), non-crew member through a crew member (N = 1), and non-crew member direct to the driver.

Five respondents felt that the individual who detected the danger should direct evasive action by the vehicle to avoid mines and boobytraps. Four thought the vehicle commander should direct the evasive action (one individual did not answer this question).

The median practical vehicle speeds for effective mine and boobytrap detection as a function of visibility and likelihood of encountering a mine and boobytrap are presented in Table 30. In general, for a given level of visibility, as the likelihood of mines and

boobytraps increased, the median practical speed indicated by the subjects decreased. Also, for all levels of mine and boobytrap likelihood, as the level of visibility decreased the median speed decreased.

Table 30

Median Practical Vehicle Speeds for Detecting Mines and Boobytraps in Combat

Visibility	No M/BTs Detected		M/BTs Probable		M/BTs Detected	
	N	Mdn.	N	Mdn.	N	Mdn.
Good	10	12.1 mph	9	4.6 mph	10	3.9 mph
Limited	10	7.3 mph	6	3.0 mph	10	3.0 mph

These results parallel the results from the Infantry and Engineer subjects. The only difference is that vehicle speeds, as expected, tended to be somewhat faster than walking speeds. However, both groups of subjects obviously take the position that as visibility becomes more limited and the likelihood of mine and boobytraps increases, speed should decrease.

EFFECT OF METALLIC AND OTHER DEBRIS

All Engineer subjects (N = 9) indicated that metallic debris and other objects (rocks, litter, signs to alert locals, etc.) hindered their detection efforts when using a mine detector. As noted in Table 31, eight of the subjects reported they were hindered either fairly often or frequently. These results indicate that this type of debris presents a significant problem for Engineer sweep teams.

Table 31

Rates of Hindrance Due to Debris, As Reported by Engineer Subjects

Rate of Hindrance	Frequency Reported (N=9)
Never	0
Seldom	1
Fairly Often	3
Frequently	5

COMMENTS AND RECOMMENDATIONS OF SUBJECTS

On being asked for additional comments and recommendations concerning mine and boobytrap detection, subjects provided suggestions in the areas of selection, training, and equipment, as well as a number of miscellaneous comments.

Point Men. It was suggested that point men be selected by (a) using men who volunteer for this duty, (b) using men picked by the squad leader, (c) using men who are small, and (d) using men who can stand the stress of combat.

Training. It was said that training should (a) be more realistic, (b) not include "scare" aspects, (c) include tracker-type training, (d) have updated publications, (e) provide training to produce detection specialists, (f) include detection, from a moving vehicle, for mounted personnel, and (g) attempt to ensure that men use in the field what they have been taught.

Equipment. It was suggested that (a) point men be provided smaller and lighter weapons, (b) new development be undertaken to provide a small detector for each man and a detection device to be placed on the front of vehicles, and (c) follow-up action be taken to insure that new developments reach the men in the field.

Miscellaneous. The diverse comments included the following: (a) Mines and boobytraps can be avoided by going through the worst terrain, (b) in certain areas, such as the highlands, boobytraps are easy to detect, (c) dogs should be kept out ahead of an advancing column, (d) tracker teams could be used to detect mines and boobytraps, (e) a machinegunner should be placed behind the point man, and (f) the danger from mines and boobytraps should be constantly emphasized.

A high percentage of the subjects questioned felt that it was possible to select individuals who had the potential of becoming effective mine and boobytrap detectors. A high percentage also said that it was possible to train individuals to become effective mine and boobytrap detectors.

Chapter 4

DISCUSSION

INDIVIDUAL CHARACTERISTICS AND DETECTION EXPERTISE

Background information, psychological characteristics, ability, aptitude, and interest were the subject variables examined in this research. In general, no relationship was found to exist between detection expertise and any of these variables.

With the exception of the dimensions measured by the HumRRO Verbal Classification Test and the ACB Pattern Analysis Test, none of the background, psychological, ability, aptitude, and interest variables studied were significantly related to detection expertise.

The failure to find a sizable number of relationships between mine and boobytrap detection expertise, as measured in this study, and the various predictor variables selected for study suggests either or both of the following conclusions: (a) the wrong predictor variables were selected for study; (b) there is no general aptitude for learning the mine and boobytrap detection task.

It is difficult to accept the possibility that the second alternative is correct. At least on the surface, it would appear that motivation should be a strong predictor of ability in this task. However, two concealed measures of motivation were included in the present predictors, with no success. The strong suggestion is that alternate approaches to measuring the predictor variables, or the ability to learn the mine and boobytrap detection task, or both, may be required.

The finding that performance on the HumRRO Verbal Classification Test (a cognitive measure) and performance on the ACB Pattern Analysis Test (a spatial ability measure) were significantly and positively related to detection expertise is not readily explainable. One possibility is that these significant relationships occurred by chance. However, further study will be necessary to discover what factor or factors (if any) mediate these relationships with detection expertise.

The practical impact of these results is that detection expertise probably is an acquired skill rather than an aptitude-oriented skill. As a consequence, future research into this area should be oriented toward determining the critical knowledge and skills required for the successful performance of detection tasks. Further, if it is true that detection expertise is an acquired skill, it is likely that proficient detectors can be identified on the basis of experience-oriented data. To determine what would be the best experience-oriented data to use for this purpose will require additional research.

TACTICS AND TECHNIQUES RELATED TO MINE AND BOOBYTRAP DETECTION

Organizations furnishing subjects for this study were very cooperative, and appeared to make a conscientious effort to provide appropriate personnel. The subjects ranged from the highly proficient acknowledged expert to individuals with a limited knowledge of mine and boobytrap detection problems.

All subjects were extremely helpful in providing answers in all areas to the best of their ability. As noted previously, information from the most knowledgeable sources was used to provide a data base for answering questions posed by MERDC. These data were also used to provide insight into the tactics and techniques related to mine and boobytrap detection problems, a discussion of which follows.

Types of Devices Detected. Eight classes of mines and boobytraps accounted for just over 90% of the devices detected by the HEx subjects. The majority of the devices detected were the type found most frequently on Infantry operations: grenade boobytraps, U.S. ordnance, and Claymore mines. Since most of the subjects responding were Infantry, this high percentage is understandable.

Detection Means. As expected, a very high percentage of devices were detected by visual means. This would seem to indicate a need to emphasize additional training in visual detection to increase the potential of what is currently our most effective detection means. The use of dogs is another means that appears to be highly regarded.

Visual Search Problem. Most subjects' visual search methods appeared to be based on the procedure of looking forward initially to detect any signs of the enemy or obvious devices, since they had to be alert for an ambush as well as mines and boobytraps. They would then look more closely in front of them in the direction of movement for signs of mines and boobytraps. This procedure was continually repeated, but always with the idea of searching for the enemy as well as mines and boobytraps.

False Indicators. False indications of mines and boobytraps were usually said to be warning signs put up by the enemy, litter of some type, soil disturbances, or similar items. Although this resulted in lost time, subjects felt the indications had to be investigated.

Detection Ability Confidence. The high degree of confidence in their detection ability expressed by HEx subjects was probably the result of considerable successful experience in this area.

Underwater Mines. Most of the subjects appeared to have had little experience and no training in detecting mines placed underwater. In view of the possible use of mines in fords, rice paddies, flooded areas, and so forth, training in this area probably deserves some attention.

Detection Distances. The great difference in the distances (both average and maximum) at which the signs of mines and boobytraps were said to be detected in good as compared to limited visibility was probably due to the occasional opportunity to see an obvious sign at a distance in good visibility. This, of course, was not possible in limited visibility.

Caution at Approach. The reduction in the rate of movement as the likelihood of encountering mines and boobytraps increased probably reflects respect for this threat and the need for time to look more carefully. This requirement for additional caution is also apparent in recommendations for the same type of actions in tactical situations where mines and boobytraps are suspected in areas a unit must move through.

Advance in Suspicious Area. When ordered to advance through an area suspected of containing mines and boobytraps while receiving fire from the enemy, the subjects indicated there was a requirement to move rapidly to get out of the enemy fire, as well as the need to exercise care in moving in order to avoid devices in the area. The decision of most to move by short rushes, carefully examining the area between moves, represented a compromise solution. The preference of most subjects in this same situation for moving by an alternate route when visual searching became impractical probably indicates a desire to avoid this type of area, if possible, when conditions prevented them from detecting these devices while moving.

Vulnerability to Enemy Fire. While most subjects agreed that maneuvering around areas that are suspected of containing mines and boobytraps can result in a loss of time

and reduction of firepower and speed, only 48% felt that the unit's vulnerability to enemy fire was reduced. This result appeared to reflect their recent Vietnam experience, where they claimed to have frequently encountered planned enemy fire while attempting to avoid these areas.

Olfactory or Auditory Means. Approximately 29% of the subjects who said they were alerted to the presence of mines and boobytraps by olfactory or auditory means usually explained that this was due to smelling or hearing the enemy, not the devices. Discussion with the subjects also indicated that the number of times a "special feeling" which seemed to warn of danger was experienced was relatively low compared to their frequent exposure. The "special feeling" usually caused them to search an area more carefully, which then often resulted in detecting a source of danger.

Variations Providing Clues. The subjects' answers on variations that provided clues to detection of mines and boobytraps was highly influenced by conditions in their area of operations, such as weather, terrain, enemy. This was generally true of enemy errors that assisted in detection and factors that adversely affected detection. The type of enemy in the area was said to be particularly important.

Fatigue/Health's Effect on Detection. The high percentage of subjects who said fatigue and deterioration in health would have an adverse effect on their detection ability indicates a requirement for planning for avoidance of these conditions. Subjects often said they would not normally put men with health problems on the point. However, they admitted they frequently had to perform this type of duty while fatigued.

Intelligence. While most subjects said that the intelligence on the mine and boobytrap situation was adequate, they often expressed a desire for overall improvement in collection and dissemination of information in this area.

Route Selection. In addition to using a zigzag direction of movement, most subjects said they stayed off the trails in order to prevent the enemy from setting up devices or ambushes along their anticipated route. Routes selected for their anticipated freedom from mines and boobytraps were usually through heavily vegetated areas. Probably because of the frequent requirement to move through this type of area, subjects said they used the file formation most often.

Marking/Disposing of Mines. The method of marking or disposing of mines appeared to depend somewhat on the type of operation involved. Where possible, many conventional units preferred to explode them in place rather than mark and leave them. Units trying to conceal their presence often did not want to mark or explode them, but would record their location for a later report.

Alternative Detection Methods. Infantry subjects indicated that dogs and a small, light mine detector were their choices to serve as alternate detection methods rather than relying on visual detection, although they had indicated confidence in their visual detection ability. Further discussion indicated that the subjects wanted these methods as supplements rather than substitutes for visual detection.

LITERATURE CITED

AND

APPENDIX

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Appendix A

CRITERIA FOR JUDGING EXPERTISE IN MINE AND BOOBYTRAP DETECTION

The initial division of subjects into categories of mine and boobytrap detection expertise was accomplished by the HumRRO interviewer, who had considerable combat experience in small-unit operations. He used basic criteria obtained from the background questionnaire and information deduced from the individual's interview to obtain a numerical rating.

The second evaluation of the subjects was conducted by another HumRRO staff member with about equal experience in small-unit operations. This evaluation also considered criteria obtained from the background questionnaire and information from the interview (obtained by listening to the tape-recorded conversation between interviewer and subject).

The methods used by th[illegible] evaluators to determine the numerical rating and relative detection expertise of subjects are described below.

I. FACTORS CONSIDERED AND SCORING SYSTEM USED BY THE INITIAL EVALUATOR

A. Special Mine and Boobytrap Training	Points
(1) Some additional training	2
(2) Extensive additional training	4

B. Time in Service	Points
0-2 Years	2
2-4 Years	3
4-6 Years	4
Over 6 Years	5

C. Time in Combat	Points
1-12 Months	4
13-24 Months	6
25-36 Months	7
37-48 Months	8
Over 48 Months	9

D. Type of Combat Duty	Points
(1) Infantry point man	8
(2) Some as Infantry point man	5
(3) Infantry NCO	4
(4) Armor crewman	4
(5) Engineer sweep team	4
(6) Engineer NCO	3
(7) Other	0 - 2

E. Type of Operation

	Points Per Percent of Time (Max 7)			
	80-100	60-79	49-59	20-39
Search & Destroy, Combat & Recon Patrols	7	6	5	4
Road Clearing	4	3	2	1
Pacification	4	3	2	1
Other: Combat related	2		1	
Noncombat related	0		0	

F. Number and Type of Mines and Boobytraps Detected

(1) Number	Points	(2) Types	Points
1-50	2	1-5	2
51-100	3	6-10	3
101-150	4	11-14	4
Over 150	5	Over 14	5

G. Knowledge Demonstrated During Interview

	Points
Outstanding	20
Excellent	15
Good	10
Fair	5
Poor	0

II. FACTORS CONSIDERED AND SCORING SYSTEM USED BY THE SECOND EVALUATOR

A. Total Army Service

Less Than 2 Years	2-4	4-6	6-8	More Than 8 Years
1	2	3	4	5

Scale

	Raw Score		Criterion Adjustment Factor		Adjusted Score
Using the scale shown above, assign the appropriate raw score, 1-5, best describing the subject's total length of Army service	_____	x	1	=	_____
Total:					

B. Army Vietnam Service

Less Than 1 Year	1-2	2-3	3-4	More Than 4 Years	Raw Score	Criterion Adjustment Factor	Adjusted Score
1	2	3	4	5			
		Scale					

Determine the subject's total length of service in Vietnam (all tours) and, using the scale shown above, assign the appropriate raw score, 1-5. If subject did not serve in Vietnam, assign a raw score of 0. .... ______ x ___3___ = ______

Total:

C. Exposure to Mines and Boobytraps

Less Than 25%	25%	50%	75%	More Than 75%	Raw Score	Criterion Adjustment Factor	Adjusted Score
1	2	3	4	5			
		Scale					

Determine the percentage of the subject's "combat time" during which he performed duties that provided him the opportunity to personally detect mines and boobytraps in areas of relatively high mine/boobytrap risk and, using the scale shown above, assign the appropriate raw score, 1-5. If subject did not serve in Vietnam, assign a raw score of 0. .... ______ x ___5___ = ______

Total:

D. Factual Knowledge

Very Little				Very Extensive	Raw Score	Criterion Adjustment Factor	Adjusted Score
1	2	3	4	5			
		Scale					

Analyze the subject's questionnaire and interview tape and, using the scale shown above, assign the raw score, 1-5, best indicating the subject's knowledge of each of the criteria listed below. If the questionnaire and interview tape do not reasonably indicate the subject's knowledge in a given area, assign a raw score of 0.

D. Factual Knowledge *(Cont.)*

Very Little				Very Extensive	Raw Score	Criterion Adjustment Factor	Adjusted Score
1	2	3	4	5			

Scale

	Raw Score		Criterion Adjustment Factor		Adjusted Score
(1) Mines and explosive and non-explosive boobytraps known or presumed to be available to the VC and the NVA (including US items used in Vietnam)	____	x	3	=	____
(2) Circumstances of weather, terrain, tactical situation, season, local inhabitants, etc., which would favor use of given items by the VC/NVA	____	x	5	=	____
(3) VC/NVA mining and boobytrapping tactics	____	x	4	=	____
(4) VC/NVA mining and boobytrapping tactics	____	x	4	=	____
(5) VC/NVA mine/boobytrap camouflage and deception techniques	____	x	4	=	____
(6) Conduct of local inhabitants relative to areas they know to be mined or boobytrapped	____	x	1	=	____
(7) VC/NVA mine/boobytrap warning marker systems	____	x	2	=	____
Total:				=	____

E. Mine Detection Related Experience

Very Little				Very Extensive	Raw Score	Criterion Adjustment Factor	Adjusted Score
1	2	3	4	5			

Scale

Analyze the subject's questionnaire and interview tape and using the scale shown above, assign the raw score, 1-5, best indicating the subject's experience, in Vietnam, in each of the criteria listed below. If the subject did not serve in Vietnam, assign a raw score of 0.

	Raw Score		Criterion Adjustment Factor		Adjusted Score
(1) Daylight patrolling operations comparable to those of an infantry rifle company	____	x	3	=	____

E. Mine Detection Related Experience (Cont.)

Very Little 1	2	3 Scale	4	Very Extensive 5	Raw Score		Criterion Adjustment Factors		Adjusted Score
(2) Patrol point in daylight patrolling operations comparable to those of an Infantry rifle company					____	x	5	=	____
(3) Patrol "slack man" in daylight patrolling operations comparable to those of an Infantry rifle company					____	x	4	=	____
(4) Search and destroy operations comparable to those of an Infantry rifle company					____	x	3	=	____
(5) Handler of mine detection dog . .					____	x	3	=	____
(6) Mine detector operator on vehicle routes					____	x	1	=	____
(7) Mine detector operator on foot trails, in and around villages, etc.					____	x	3	=	____
(8) Operations (any type) in areas with high levels of VC/NVA antipersonnel mining and boobytrapping					____	x	3	=	____
(9) Visual observer of a mine sweep team					____	x	2	=	____
(10) Visual Observer for wheeled or tracked vehicles					____	x	2	=	____
(11) Any other positions in which principal task was visual detection of mines and boobytraps					____	x	4	=	____
(12) Emplacing mines and boobytraps					____	x	1	=	____
(13) Disarming mines and boobytraps					____	x	1	=	____
(14) Destroying mines and boobytraps in place					____	x	2	=	____
Total:									

HUMAN RESOURCES RESEARCH ORGANIZATION

300 North Washington Street • Alexandria, Virginia 22314

President	Dr. Meredith P. Crawford
Executive Vice President	Dr. William A. McClelland
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RESEARCH DIVISIONS

HumRRO Division No. 1 (System Operations) 300 North Washington Street Alexandria, Virginia 22314	Dr. J. Daniel Lyons Director
HumRRO Division No. 2 Fort Knox, Kentucky 40121	Dr. Donald F. Haggard Director
HumRRO Division No. 3 Post Office Box 5787 Presidio of Monterey, California 93940	Dr. Howard H. McFann Director
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